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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/544,822 04/06/00 JIANG T 4241US

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MM21/0925

EXAMINER

JONES, J

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 09/25/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/544,822

Applicant(s)

JIANG, TONGBI

Examiner

Josetta I. Jones

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-62 is/are pending in the application.
- 4a) Of the above claim(s) 33-57 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 62 is/are allowed.
- 6) ☒ Claim(s) 1-2, 4-6, 9-32 and 58-60 is/are rejected.
- 7) ☒ Claim(s) 3, 7, 8 and 61 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless —

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 1-2, 5-6, 9-12, 15 and 58-60 are rejected under 35 U.S.C. 102(e) as being anticipated by Kodnani et al., U.S. Patent No. 6,248,614.

With regard to claim 1, Kodnani et al disclose applying a wetting agent layer to one of said surface of said semiconductor device and said surface of said substrate (see column 4, lines 40-65; column 7, lines 31-35; and column 7, lines 60-64); and applying a flowable material between the substrate and the semiconductor device (see column 7, lines 1-7).

With regard to claim 2, Kodnani et al disclose wherein said semiconductor device is attached to said substrate (see column 7, lines 1-3).

With regard to claim 5, Kodnani et al disclose wherein said wetting agent layer comprises at least one layer (see column 4, lines 40-65).

With regard to claim 6, Kodnani et al disclose wherein said wetting agent layer comprises one or more layers (see column 4, lines 40-65).

With regard to claim 9, Kodnani et al disclose wherein said applying said wetting agent layer comprises providing a material for increasing the surface tension to one of

Art Unit: 2812

said active surface and said top surface for the application of an underfill material (see column 4, lines 49-52 and column 7, lines 31-35).

With regard to claim 10, Kodnani et al disclose providing a semiconductor device having an active surface, another surface, a first end, a second end, a first lateral side and a second lateral side, said first end, said second end, said first lateral side, and said second lateral side forming at least a portion of a periphery of said semiconductor device (see column 4, lines 32-34 and figure 3); providing a substrate having an upper surface, a first side wall, a second side wall, a first lateral side wall and a second lateral side wall (see figure 3); applying a wetting agent layer to one of said active surface of said semiconductor and said upper surface of said substrate (see figure 3; column 4, lines 40-65 and column 7, lines 31-35); and applying a flowable material between said semiconductor device and said substrate (see column 7, lines 1-7).

With regard to claim 11, Kodnani et al disclose wherein said flowable material is applied substantially adjacent to at least one end of said semiconductor device (see column 7, lines 1-7 and figure 3).

With regard to claim 12, Kodnani et al disclose wherein said flowable material substantially fills a gap between said semiconductor device and said substrate (see column 7, lines 1-7 and figure 3).

With regard to claim 15, Kodnani et al disclose wherein said flowable material is provided substantially adjacent to said at least a portion of the periphery of said semiconductor device to fill a gap between said substrate and said semiconductor device (see column 7, lines 1-7 and figure 3).

With regard to claim 58, Kodnani et al disclose providing a semiconductor device having an active surface (see column 4, lines 32-35 and figure 3); providing a substrate having an upper surface (see column 7, lines 30-35 and figure 3); applying a wetting agent layer to one of said active surface of said semiconductor device and said upper surface of said substrate (see column 4, lines 40-65 and column 7, lines 30-35); connecting said semiconductor device to said substrate so that said active surface of said semiconductor devices faces said upper surface of said substrate (see column 7, lines 1-3 and figure 3); and applying an underfill material between the substrate and the semiconductor device (see column 7, lines 1-7).

With regard to claim 60, Kodnani et al disclose wherein said wetting agent layer comprises at least one layer (see column 4, lines 40-65).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4, 13-14, 16-30 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kodnani et al., U.S. Patent No. 6,248,614 as applied to claims 1-2, 5-6, 9-12, 15 and 58-60 above, and further in view of Akram et al., U.S. Patent No. 5,766,982.

Kodnani et al fail to disclose the following steps: (1) wherein said applying said wetting agent layer comprises any one of a dispensing method, a brushing method, and a spraying method (claims 4, 59); (2) wherein said substrate includes an aperture extending through said substrate (claim 13); (3) wherein said aperture is located adjacent to said another surface of said semiconductor device (claim 14); (4) elevating at least said first side wall of said substrate and said first end of said semiconductor device (claim 16); (5) wherein said elevating said first side wall of said substrate comprises placing said substrate on a support structure and elevating at least one portion of said support structure (claim 17); (6) providing a dam on the substrate adjacent to at least one of said first end, said second end, said first lateral side and said second lateral side of said semiconductor device (claim 18); (7) wherein said dam extends to substantially between said semiconductor device and said substrate (claim 19); (8) vibrating one of said semiconductor device and said substrate (claim 20); (9) wherein said vibrating one of said semiconductor device and said substrate comprises placing said substrate on a support structure and vibrating said support structure (claim 21); (10) providing said flowable material substantially adjacent said first end of said semiconductor device for filling between said substrate and said semiconductor device by one or more forces acting upon said flowable material (claim 22); (11) wherein said substrate includes at least one aperture extending through said substrate and substantially located adjacent to said another surface of said semiconductor device (claim 23); (12) wherein said flowable material is provided through said at least one aperture of said substrate substantially filling a gap between said substrate and said

semiconductor device (claim 24); (13) providing said flowable material substantially adjacent to said first end of said semiconductor device for filling a gap between said substrate and said semiconductor device (claim 25); (14) providing said flowable material substantially adjacent to said first end and one of said first lateral side and said second lateral side of said semiconductor device for filling a gap between said substrate and said semiconductor device (claim 26); (15) wherein said substrate includes at least one aperture extending therethrough and substantially located adjacent to said another surface of said semiconductor device (claim 27); (16) wherein said flowable material is provided through said at least one aperture (claim 28); (17) wherein said flowable material is provided from below said substrate (claim 29); (18) wherein said flowable material is provided through said at least one aperture contacting at least a portion of said another surface of said semiconductor device (claim 30); (19) wherein said applying flowable material between said semiconductor device and said substrate further comprises placing said semiconductor device and said substrate in a chamber, said chamber having an atmosphere therein having a variable pressure (claim 31); (20) varying the pressure of said atmosphere in said chamber for said flowable material substantial filling a gap between said semiconductor device and said substrate (claim 32).

With regard to claims 4 and 59, examiner takes official notice that it would have been obvious to one skilled in the art at the time of the invention to apply a wetting agent layer by a dispensing method, a brushing method or a spraying method because those are well known methods of application that provide a uniform wetting agent layer.

With regard to claim 13, Akram et al disclose wherein said substrate includes an aperture extending through said substrate (see figures 5-7 and column 6, lines 65-67 and column 7, lines 1-2). It would have been obvious to one skilled in the art at the time of the invention to have an aperture in the substrate that is used in the underfill process because such an opening provides an even distribution of underfill between the substrate and the semiconductor device.

With regard to claim 14, Akram et al disclose wherein said aperture is located adjacent to said another surface of said semiconductor device (see figure 7). It would have been obvious to one skilled in the art at the time of the invention to locate the aperture adjacent to another surface of the semiconductor device because such a location provides an even distribution of underfill.

With regard to claim 16, Akram et al disclose elevating at least said first side wall of said substrate and said first end of said semiconductor device (see column 7, lines 16-17 and column 7). It would have been obvious to one skilled in the art at the time of the invention to elevate a first side wall of the substrate and first end of said semiconductor device because elevating the wall and end allows the underfill to flow to the other side of the package and not collect unevenly on one side of the package.

With regard to claim 17, Akram et al disclose wherein said elevating said first side wall of said substrate comprises placing said substrate on a support structure and elevating at least one portion of said support structure (see figures 5-7 and column 4, lines 35-38). It would have been obvious to one skilled in the art at the time of the

Art Unit: 2812

invention to place the substrate on a support structure because the support structure provides stability to the substrate and device that is being elevated.

With regard to claim 18, Akram et al disclose providing a dam on the substrate adjacent to at least one of said first end, said second end, said first lateral side and said second lateral side of said semiconductor device (see column 7, lines 2-15). It would have been obvious to one skilled in the art at the time of the invention to provide a dam on the substrate adjacent to the ends and sides of the semiconductor because a dam is useful in containing underfill dispensed between the device and the substrate.

With regard to claim 19, Akram et al disclose wherein said dam extends to substantially between said semiconductor device and said substrate (see figure 7). It would have been obvious to one skilled in the art at the time of the invention to extend the dam substantially between the device and substrate because the location of the dam prevents the distribution of the underfill outside of the device/ substrate region.

With regard to claim 20, Akram et al disclose vibrating one of said semiconductor device and said substrate (see column 5, lines 66-67 and column 6, lines 1-5). It would have been obvious to one skilled in the art at the time of the invention to vibrate one of the device and the substrates voids are filled with underfill.

With regard to claim 21, Akram et al disclose wherein said vibrating one of said semiconductor device and substrate comprises placing said substrate on a support structure and vibrating said support structure (see column 5, lines 56-66). It would have been obvious to one skilled in the art at the time of the invention to place the device and

substrate on a support structure and vibrate the structure because the structure provides stability for the substrate and the device.

With regard to claim 22, Akram et al disclose providing said flowable material substantially adjacent said first end of said semiconductor device for filling between said substrate and said semiconductor device by one or more forces acting upon said flowable material (see column 4, lines 60+ and column 5, lines 1-15). It would have been obvious to one skilled in the art at the time of the invention to provide a flowable material adjacent the first end of the semiconductor device for filling between the substrate and device by one or more forces because the flowable material is contained in a specified area between the device and the substrate and once the material is introduced into the area, forces will act to move the material.

With regard to claim 23, Akram et al disclose wherein the substrate includes at least one aperture extending through said substrate and substantially located adjacent to another surface of said semiconductor device (see column 6, lines 65-67 and figure 7). It would have been obvious to one skilled in the art at the time of the invention to include at least one aperture extending through said substrate and substantially located adjacent another surface of the device because the aperture provides a centralized point of entry for the underfill to flow into the space between the device and substrate.

With regard to claim 24, Akram et al disclose wherein said flowable material is provided through said at least one aperture of said substrate substantially filling a gap between said substrate and said semiconductor device (see figure 7). It would have been obvious to one skilled in the art at the time of the invention to substantially fill the

gap using the aperture because this method provides another well known method of uniformly distributing underfill material.

With regard to claim 25, Akram et al disclose providing said flowable material substantially adjacent to said first end of said semiconductor device for filling a gap between said substrate and said semiconductor device (see figure 7). It would have been obvious to one skilled in the art at the time of the invention to provide a flowable material adjacent the first end of the semiconductor device for filling a gap between the substrate and device because the material would distribute evenly.

With regard to claim 26, Akram et al disclose providing said flowable material substantially adjacent to said first end and one of said first lateral side and second lateral side of said semiconductor device for filling a gap between said substrate and said semiconductor device (see figure 7). It would have been obvious to one skilled in the art at the time of the invention to provide that location of the flowable material to provide uniform, even distribution in the gap between the device and substrate.

With regard to claim 27, Akram et al disclose wherein said substrate includes at least one aperture extending therethrough and substantially located adjacent to said another surface of said semiconductor device (see column 7). It would have been obvious to one skilled in the art at the time of the invention to provide that location of the flowable material to provide uniform, even distribution in the gap between the device and substrate.

With regard to claim 28, Akram et al disclose wherein said flowable material is provided through said at least one aperture (see figure 7). It would have been obvious

to one skilled in the art at the time of the invention to provide the flowable material through at least one aperture because the aperture provides an entry point of the material.

With regard to claim 29, Akram et al disclose wherein said flowable material is provided from below said substrate (see figure 7). It would have been obvious to one skilled in the art at the time of the invention for the flowable material to be provided from below the substrate because inputting the material below the substrate does not run the risk of inadvertently soiling other parts of the device with underfill material.

With regard to claim 30, Akram et al disclose wherein said flowable material is provided through said at least one aperture contacting at least a portion of said another surface of said semiconductor device (see figure 7). It would have been obvious to one skilled in the art at the time of the invention to have the flowable material contact at least a portion of the surface of the device so that the underfill material does not have any large "air pockets" between the device and the substrate and so that the device is well set on the substrate.

Claims 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kodnani et al., U.S. Patent No. 6,248,614 as applied to claims 1-2, 5-6, 9-12, 15 and 58-60 and Akram et al., U.S. Patent No. 5,766,982 as applied to claims 4, 13-14, 16-30 and 59 above, and further in view of Banerji et al., U.S. Patent No. 5,203,076.

Kodnani et al and Akram et al fail to disclose the following steps: (1) wherein said applying said flowable material between said semiconductor device and said substrate

further comprises placing said semiconductor device and said substrate in a chamber, said chamber having an atmosphere therein having a variable pressure (claim 31); and (2) varying the pressure of said atmosphere in said chamber for said flowable material substantially filling a gap between said semiconductor device and said substrate.

With regard to claim 31, Banerji et al disclose wherein said applying said flowable material between said semiconductor device and said substrate further comprises placing said semiconductor device and said substrate in a chamber, said chamber having an atmosphere therein having a variable pressure (see column 2, lines 49-57). It would have been obvious to one skilled in the art at the time of the invention to place the semiconductor device and substrate in a chamber when applying the flowable material process because the pressure chamber allows for distribution of the underfill without voids.

With regard to claim 32, Banerji et al disclose varying the pressure of said atmosphere in said chamber for said flowable material substantially filling a gap between said semiconductor device and said substrate (see column 2, lines 55-68 and column 3, lines 1-10). It would have been obvious to one skilled in the art at the time of the invention to vary the pressure of the chamber so that the underfill material can flow and fill out the gap between the device and the substrate without creating any voids.

Allowable Subject Matter

Claims 3, 7-8 and 61 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 62 is allowed.

The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to disclose wherein said wetting agent layer includes a layer of silane; wherein said wetting agent layer comprises a plurality of layers; wherein said wetting agent layer comprises one of glycidoxypolytinethoxysilane and ethyltrimethoxysilane.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Master et al., U.S. Patent No. 6,103,549; Desai et al., U.S. Patent No. 6,251,766; Umbaugh, U.S. Patent No. 3,869,787.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Josetta I. Jones whose telephone number is 703-308-5871. The examiner can normally be reached on M-F 9:00-6:30 and alternating Fridays 9:00-5:30.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John F. Niebling can be reached on 703-308-3325. The fax phone numbers

Application/Control Number: 09/544,822
Art Unit: 2812

Page 14

for the organization where this application or proceeding is assigned are 703-305-3432 for regular communications and 703-305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


Josetta I. Jones
September 20, 2001


John F. Niebling
Supervisory Patent Examiner
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